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PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-049190

(43)Date of publication of application : 15.02.2002

(51)Int.Cl.

G03G 15/00
G03G 15/01
G03G 15/043
G03G 15/04
G03G 15/16

(21)Application number : 2000-234329

(71)Applicant : SEIKO EPSON CORP

(22)Date of filing : 02.08.2000

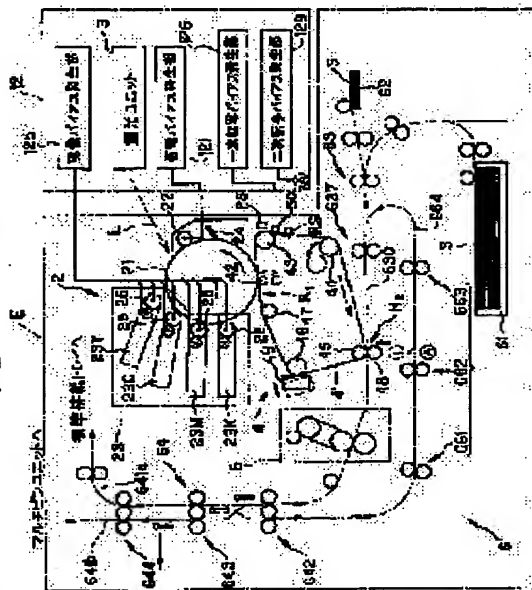
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(54) IMAGE FORMING SYSTEM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an image forming system capable of stabilizing transfer efficiency by eliminating the fluctuation of the surface potential of an intermediate transfer medium in the case of using a constant-voltage power source as a primary transfer voltage power source.

SOLUTION: This image forming device is provided with a latent image carrier 21, plural developing devices 23Y, 23M, 23C and 23K, a primary transfer part R1 transferring a toner image successively developed with different color toner to the intermediate transfer medium 41, a primary transfer bias applying power source 126 for applying bias at the primary transfer part, and a secondary transfer part R2 transferring the full color toner image superposed and transferred on the intermediate transfer medium to recording paper. In the device, the constant-voltage power source is used as the primary transfer bias applying power source, and the electrification potential of a latent image carrier by an electrifying means 22 is fixed at least for each color toner and the gradation of the image is adjusted by adjusting the quantity of exposing light L to an image part.



LEGAL STATUS

[Date of request for examination]

02.06.2003

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision
of rejection]

[Date of requesting appeal against examiner's
decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]

[Claim 1] Latent-image support in which it is uniformly charged on the surface with an electrification means, rotating, it discharges alternatively with an exposure means, and an electrostatic latent image is formed Two or more development counters which give a color toner of an alternatively different color to the surface of this latent-image support, and use said latent image as a visible image The primary imprint section which imprints a toner image developed with a color toner of a different color one by one to a middle transfer medium A primary imprint bias impression power supply for impressing bias in the primary imprint section The secondary imprint section which imprints all color color toner images piled up and imprinted on a middle transfer medium on the recording paper It is the image formation method equipped with the above; and a constant voltage power supply is used as said primary imprint bias impression power supply, electrification potential of said latent-image support by said electrification means is fixed at least to a color toner of each color, and it is characterized by performing gradation adjustment of an image by adjusting light exposure to the image section.

[Claim 2] An image formation method according to claim 1 characterized by for said middle transfer medium consisting of multiple-layer structure which has a conductive layer and a resistive layer by which it is formed in one on this conductive layer, and a toner is imprinted, and impressing said primary imprint bias through said conductive layer.

[Claim 3] An image formation method according to claim 1 or 2 characterized by using a constant current power supply as a secondary imprint bias impression power supply for impressing bias in the secondary imprint section.

[Claim 4] An image formation method of three given in any 1 term from claim 1 characterized by fixing identically electrification potential of said latent-image support by said electrification means to a color toner of all colors.

[Claim 5] An image formation method of three given in any 1 term from claim 1 characterized by being set up so that electrification potential of said latent-image support according [imprint sequence of a toner image which electrification potentials of said latent-image support by said electrification means differ for every color of a color toner, and imprint to said middle transfer medium] to said electrification means may serve as a color toner of a high color sequentially from a color toner of a lower color.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the image formation method of image formation equipment equipped with the middle transfer medium which the toner image especially formed on latent-image support, such as a photo conductor, is imprinted primarily, and imprints this toner image secondarily to a record medium further about the image formation method of image formation equipments, such as a printer which used the xerography, facsimile, and a copying machine.

[0002]

[Description of the Prior Art] Generally the image formation equipment using electrophotographic technology The photo conductor which has a sensitization layer in the peripheral face as latent-image support, and an electrification means to electrify the peripheral face of this photo conductor uniformly, An exposure means to expose alternatively the peripheral face uniformly electrified by this electrification means, and to form an electrostatic latent image, It has the development means which the toner as a developer is electrified in the electrostatic latent image formed by this exposure means, gives to it, and is used as a visible image (toner image), and imprint equipment which makes record media, such as a form, imprint the toner image developed by this development means.

[0003] And as imprint equipment which makes record media, such as a form, imprint the toner image developed on the photo conductor, the thing equipped with the middle transfer medium which the toner image formed on the photo conductor is imprinted (primary imprint), and imprints this toner image to a record medium further (secondary imprint) is known conventionally.

[0004] Drawing 8 is drawing showing one example of image formation equipment equipped with such a middle transfer medium, and is a b-b fragmentary sectional view [in / (a) and / in (b) / drawing (a)]. [an outline perspective diagram]

[0005] In drawing 8 , 201 is a photo conductor and has conductive layer 201a and sensitization layer 201b formed on this conductive layer 201a. Conductive layer 201a is grounded.

[0006] 202 is a middle transfer medium, for example, the volume-resistivity value consists of 10⁷–10¹⁴ohm dielectrics it is [dielectrics] of abbreviation cm (inside resistive layer). Such a middle transfer medium 202 can be created by kneading conductive carbon to synthetic resin etc.

[0007] The middle transfer medium 202 contacts a photo conductor 201 at the time of image formation at least, and this contact section R1 forms the primary imprint section. In the primary imprint section R1, the primary imprint roller 203 is arranged among the middle transfer media 202 at the way, and primary imprint voltage is impressed to the middle transfer medium 202 by the pressure welding of this primary imprint roller 203.

[0008] Moreover, the pressure welding of the secondary imprint roller 204 which impresses secondary imprint voltage is carried out to the middle transfer medium 202, and this pressure-welding section forms the secondary imprint section R2. The backup roller 205 is arranged from the way among the middle transfer media 202 at the secondary imprint section R2.

[0009] At the time of image formation, after the rotation drive of a photo conductor 201 and the

middle transfer medium 202 is carried out and sensitization layer 201b of a photo conductor 201 is first electrified uniformly with an electrification means (not shown), it is alternatively exposed with an exposure means (not shown), and an electrostatic latent image is formed. Subsequently, the toner which is a developer is given to an electrostatic latent image by the development means (not shown), and it becomes a visible image (toner image), and this toner image is imprinted on the middle transfer medium 202 in the primary imprint section R1, and is imprinted by record media, such as a form supplied to this secondary imprint section R2, in the secondary imprint section R2 after that.

[0010] When the record medium with which the toner image was imprinted passes the fixing assembly which is not illustrated, it is fixed to a toner image.

[0011] In the image formation equipment which has the middle transfer medium 202 formed by the above uniform resistors, generally, although imprint electric field are given by the primary imprint roller 203 which contacts an imprint section rear face, when distortion etc. occurs in the middle transfer medium 202 or a contaminant adheres to the primary imprint roller 203, it becomes impossible to give electric field partially, and unevenness occurs in the image which the electric field of the imprint section became uneven and was imprinted.

[0012] Then, conductive layer 202a formed in one as a middle transfer medium 202 on insulating base 202c which consists of synthetic resin as shown in drawing 9. The thing using what consisted of resistive layer 202b by which is formed in one on it and a pressure welding is carried out to a photo conductor 201 is also known. In that case In the side edge section of that middle transfer medium 202, resistive layer 202b is removed to band-like, and conductive layer 202a is exposed to band-like, and an electrode roller contacts this outcrop and he is trying to impress primary *****. Thus, in the image formation equipment using the middle transfer medium 202 which has conductive layer 202a, since the electric field of a uniform imprint can be given throughout the imprint section also when distortion occurs in the middle transfer medium 202 or a contaminant adheres to the roller of the imprint section, it has the advantage in which the image unevenness resulting from an imprint is lost.

[0013] In the image formation equipment using the middle transfer medium 202 which has conductive layer 202a to which such primary ***** is impressed, in order to have to make the timing of a primary imprint and a secondary imprint have to lap for improvement in the speed, a constant voltage power supply is used as a primary imprint voltage power supply, and the constant current power supply is used as a secondary imprint voltage power supply (JP,9-160395,A).

[0014] In addition, in U.S. Pat. No. 5,243,392, a volume-resistivity value is 1012ohms more than of abbreviation cm, and the thing to which the relaxation time makes a secondary imprint perform efficiently using middle imprint object data medium of the high resistance belt of 0.3 - 200ms is proposed.

[0015]

[Problem(s) to be Solved by the Invention] In a configuration like drawing 8 and drawing 9, although the phenomenon from which a toner scatters between Rhine or it escapes makes it generating notably, and deterioration of the Rhine image will be remarkable or will be easy to generate photo conductor memory if the low middle transfer medium 202 of a volume resistivity is used, these problems are solvable by making the volume resistivity of the middle transfer medium 202 to some extent high.

[0016] However, if resistivity becomes high, the charge from a photo conductor will be charged in a middle transfer medium, it will be hard coming to escape a charge, and a problem will arise. If it specifically becomes beyond the fixed potential difference with photo conductor surface potential and the belt surface potential of a middle transfer medium, discharge will arise, and it happens that a middle transfer medium is charged by the middle transfer medium in response to the minus charge of a photo conductor (when carrying out minus electrification of the photo conductor). Photo conductor surface potential V0 It is usually the photo conductor surface potential V0 by property change change with development properties of a development counter and according to the color of a development counter, or the elapsed time from the early stages of use etc. The set points differ greatly. Therefore, the amount of negative charges which a

middle transfer medium receives from a photo conductor will also be various, and middle transfer-medium surface potential will be stabilized.

[0017] Since fixed work is done to the photo conductor image section by carrying out constant current control of the primary imprint, the problem by middle transfer-medium surface potential not being stabilized at the moment of imprinting primarily at least is not produced.

[0018] However, as described above, when a constant voltage power supply was used as a primary imprint voltage power supply, middle transfer-medium surface potential fell greatly, and since the condition that the potential difference with the photo conductor image section ran short was not canceled, it turned out that the problem that imprint effectiveness falls arises.

[0019] then, although it is possible to enlarge primary imprint voltage impressed to a middle transfer medium, if it is enlarged too much, shortly, it will obtain, if it becomes easy to generate photo conductor memory with primary imprint voltage, and a problem will arise.

[0020] It is offering [this invention is made in view of such a trouble of the conventional technology, and]-image formation method which the purpose loses [method] fluctuation of middle transfer-medium surface potential in case of using constant voltage power supply as primary imprint voltage power supply, and stabilizes imprint effectiveness ****.

[0021]

[Means for Solving the Problem]. An image formation method of this invention which attains the above-mentioned purpose Latent-image support in which it is uniformly charged on the surface with an electrification means, rotating, it discharges alternatively with an exposure means, and an electrostatic latent image is formed, Two or more development counters which give a color toner of an alternatively different color to the surface of this latent-image support, and use said latent image as a visible image, The primary imprint section which imprints a toner image developed with a color toner of a different color one by one to a middle transfer medium, In image formation equipment which has a primary imprint bias impression power supply for impressing bias in the primary imprint section, and the secondary imprint section which imprints all color color toner images piled up and imprinted on a middle transfer medium on the recording paper A constant voltage power supply is used as said primary imprint bias impression power supply, electrification potential of said latent-image support by said electrification means is fixed at least to a color toner of each color, and it is characterized by performing gradation adjustment of an image by adjusting light exposure to the image section.

[0022] In this case, a middle transfer medium consists of multiple-layer structure which has a conductive layer and a resistive layer by which it is formed in one on this conductive layer, and a toner is imprinted, and it is desirable that it is that to which primary imprint bias is impressed through a conductive layer.

[0023] Moreover, it is desirable to use a constant current power supply as a secondary imprint bias impression power supply for impressing bias in the secondary imprint section.

[0024] Moreover, electrification potential of latent-image support by electrification means may be identically fixed to a color toner of all colors.

[0025] Moreover, electrification potentials of latent-image support by electrification means differ for every color of a color toner, and it may be set up so that electrification potential of latent-image support according [imprint sequence of a toner image imprinted to a middle transfer medium] to an electrification means may serve as a color toner of a high color sequentially from a color toner of a lower color.

[0026] In this invention, a constant voltage power supply is used as a primary imprint bias impression power supply, and electrification potential of latent-image support by electrification means Since it is fixed at least to a color toner of each color and gradation adjustment of an image is performed by adjusting light exposure to the image section Fluctuation of surface potential on a middle transfer medium while imprinting a toner image of a different color to a middle transfer medium in order can be sharply made small, imprint effectiveness to a middle transfer medium of a toner image can be stabilized, and image formation equipment which is reliable, without also producing a cost rise of equipment can be realized.

[0027]

[Embodiment of the Invention] Hereafter, the configuration of the whole of one example of the

printer of the image formation equipment using the xerography which applies the image formation method of this invention is explained.

[0028] Drawing 1 is drawing showing one operation gestalt of the image formation equipment which applies the image formation method of this invention. Moreover, drawing 2 is the block diagram showing the electric configuration of the image formation equipment of drawing 1. This image formation equipment is yellow (Y), cyanogen (C), a Magenta (M), and equipment that piles up the toner of four colors of black (K) and forms a monochrome image, using only the toner of black (K) in forming a full color image ****, if a picture signal is given to the Maine controller 11 of a control unit 1 from external devices, such as a host computer, with this image formation equipment — the command from this Maine controller 11 — responding — en zincon — each part of the engine section E on which truck 12 fatty tuna functions as an image formation means is controlled, and the image corresponding to a picture signal is formed in Sheet S.

[0029] A toner image can be formed in the photo conductor 21 of the image support unit 2 in this engine section E. That is, the ***** unit 2 is equipped with the pivotable photo conductor 21 in the direction of an arrow head of drawing 1, and the electrification roller 22 as an electrification means, the development counters 23Y, 23C, 23M, and 23K as a development means, and the cleaning section 24 are further arranged along the hand of cut, respectively around the photo conductor 21. The high voltage is impressed from the electrification bias generating section 121, and the electrification roller 22 electrifies a peripheral face in homogeneity in contact with the peripheral face of a photo conductor 21. The photo conductor 21 has conductive layer 21a and sensitization layer 21b formed on this conductive layer 21a, as shown in drawing 3.

[0030] And laser beam L is irradiated from the exposure unit 3 towards the peripheral face of the photo conductor 21 charged with this electrification roller 22. As shown in drawing 2, it connects with the picture signal change over section 122 electrically, and this exposure unit 3 carries out scan exposure of the laser beam L on a photo conductor 21 according to the picture signal given through this picture signal change over section 122, and forms the electrostatic latent image corresponding to a picture signal on a photo conductor 21. For example, when the picture signal change over section 122 has flowed with the patch creation module 124 based on the command from CPU123 of the engine controller 12, the patch picture signal outputted from the patch creation module 124 is given to the exposure unit 3, and a patch latent image is formed. On the other hand, when the picture signal change over section 122 has flowed with CPU111 of the Maine controller 11, according to the picture signal given through the interface 112 from external devices, such as a host computer, scan exposure of the laser beam L is carried out on a photo conductor 21, and the electrostatic latent image corresponding to a picture signal is formed on a photo conductor 21.

[0031] In this way, toner development of the formed electrostatic latent image is carried out by the development section 23. That is, in this operation gestalt, development counter 23K for development counter 23M and blacks development counter 23Y for yellow, development counter 23C for cyanogen, and for Magentas are arranged along with the photo conductor 21 as the development section 23 in this sequence. These development counters 23Y, 23C, 23M, and 23K While it is constituted free [attachment and detachment] to the photo conductor 21, respectively and one development counter in the four above-mentioned development counters 23Y, 23M, 23C, and 23K contacts a photo conductor 21 alternatively according to the command from the engine controller 12 By the development bias generating section 125, the high voltage gives the toner of the color impressed and chosen as the developing roller 25 of a development counter to the surface of a photo conductor 21, and actualizes the electrostatic latent image on a photo conductor 21.

[0032] the toner image developed in the development section 23 — the object for blacks — it imprints primarily on the middle imprint belt 41 of the imprint unit 4 in the primary imprint field R1 located between development counter 23K and the cleaning section 24. In addition, the structure of this imprint unit 4 is explained in full detail later.

[0033] Moreover, it is failed after a primary imprint for the cleaning section 24 to be arranged from the primary imprint field R1 in the location which went to the hoop direction (the direction

of an arrow head of drawing 1), and to scratch the toner which is carrying out residual adhesion to the peripheral face of a photo conductor 21.

[0034] Next, the configuration of the imprint unit 4 is explained. The imprint unit 4 is equipped with rollers 42-47, the middle imprint belt 41 over which each [these] rollers 42-47 were built, and the secondary imprint roller 48 which imprints secondarily the middle toner image imprinted by this middle imprint belt 41 on Sheet S with this operation gestalt.

[0035] Like the conventional example explained by drawing 9 , as a cross section is shown in drawing 3 , this middle imprint belt 41 Conductive layer 41a formed in one on insulating base 41c which consists of synthetic resin, What consisted of resistive layer 41b by which is formed in one on it and a pressure welding is carried out to a photo conductor 21 is used. In the side edge section of that middle imprint belt 41, resistive layer 41b is removed to band-like, conductive layer 41a is exposed to band-like, and when the electrode roller 50 contacts this outcrop, primary imprint voltage is impressed from the primary imprint bias generating section 126. and in imprinting a color picture on Sheet S Make the primary imprint backup roller 42 **** to a continuous line location, and the pressure welding of the middle imprint belt 41 is carried out to a photo conductor 21. It is made to imprint on the middle imprint belt 41 with the primary imprint voltage to which the toner image of each color formed on a photo conductor 21 was impressed by conductive layer 41a of the middle imprint belt 41. While carrying out the circulation drive of a photo conductor 21 and the middle imprint belt 41, piling up and imprinting the toner image of each color on the middle imprint belt 41 and forming a color image By the feed section 63 of the feeding-and-discarding paper unit 6, Sheet S is picked out from a cassette 61, a detachable tray 62, or an extension cassette (illustration abbreviation), and it conveys to secondary imprint **** R2. And to the secondary imprint backup roller 45, the secondary imprint roller 48 is made to **** to a continuous line location, a pressure welding is carried out from the rear-face side of Sheet S, secondary imprint voltage is impressed from the secondary imprint bias generating section 129, a color image is secondarily imprinted on this sheet S, and a full color image is obtained. Moreover, in imprinting a monochrome image on Sheet S, only a black toner image is formed on a photo conductor 21, and it imprints on the middle imprint belt 41, it imprints on the sheet S conveyed to the secondary imprint field R2 like the case of a color picture, and obtains a monochrome image.

[0036] In addition, about the toner which is carrying out residual adhesion, it is removed by the peripheral face of the middle imprint belt 41 with a belt cleaner 49 after a secondary imprint. On both sides of the middle imprint belt 41, this belt cleaner 49 counters with a roller 46, is arranged, and a cleaner blade contacts to the middle imprint belt 41 to suitable timing, and it fails to scratch the toner which is carrying out residual adhesion to that peripheral face.

[0037] Moreover, while the patch sensor PS for detecting the concentration of the patch image formed in the peripheral face of the middle imprint belt 41 near the roller 43 is arranged, the reading sensor RS for a synchronization for detecting the criteria location of the middle imprint belt 41 is arranged.

[0038] It returns to drawing 1 and configuration explanation of the engine section E is continued. The sheet S with which the toner image was imprinted by the imprint unit 4 is conveyed by the fixing unit 5 arranged in the downstream of ***** secondary imprint **** R2 by the predetermined feed path (two-dot chain line) by the feed section 63 of the feeding-and-discarding paper unit 6, and is fixed to Sheet S in the toner image on the sheet S conveyed. And the sheet S concerned meets the feed path 630 further, and is conveyed by the delivery unit 64.

[0039] While this delivery unit 64 has two delivery paths 641a and 641b and one delivery path 641a is prolonged in a standard paper output tray from the fixing unit 5, delivery path 641b of another side is prolonged between the re-feeding section 66 and a multi-bottle unit in delivery path 641a and abbreviation parallel. In accordance with these delivery paths 641a and 641b, 3 sets of roller pair 642-644 are prepared, turn the sheet [finishing / fixing] S to a standard paper output tray and multi-bottle unit side, and it discharges, or in order to form an image also in the another side side side, it conveys to the re-feeding section 66 side.

[0040] the sheet S by which reversal conveyance has been carried out as mentioned above from

the delivery unit 64 as this re-feeding section 66 is shown in drawing 1 — the re-feeding path 664 (two-point ****) — meeting — the gate roller pair of the feed section 63 — three which conveys to 637 and were arranged in accordance with the re-feeding path 664 — re — it consists of feed roller pair 661–663. thus, the sheet S conveyed from the delivery unit 64 — the re-feeding path 664 — meeting — a gate roller pair — by returning to 637, in the feed section 63, the non-image formation side of Sheet S turns to the middle imprint belt 41, and the secondary imprint of an image of it is attained in the field concerned.

[0041] In addition, in order to memorize the image with which the sign 113 was given through the ITA face 112 in drawing 2 from external devices, such as a host computer, it is the image memory established in the Maine controller 11, and a sign 127 is RAM for memorizing temporarily the result of an operation in control data and CPU123 for controlling the engine section E etc., and a sign 128 is ROM which memorizes the operation program performed by CPU123 further.

[0042] Here, in above image formation equipment, the primary imprint bias generating section 126 which impresses primary imprint voltage to the middle imprint belt 41 in the primary imprint section R1 consists of constant voltage power supplies, and the secondary imprint bias generating section 129 which impresses secondary imprint voltage to the secondary imprint roller 48 in the secondary imprint field R2 consists of constant current power supplies.

[0043] Moreover, it is the volume resistivity of resistive layer 41b of the middle imprint belt 41 at the primary imprint voltage 250V impression time, and it is 1.5×10^{12} -ohmcm (23 degrees C, 65% RH).

[0044] The case where carry out minus electrification at a photo conductor 21, and reversal development is carried out with a minus electrification 1 component nonmagnetic toner using such equipment with development counters 23Y, 23C, 23M, and 23K is examined.

[0045] First, change of the surface potential of the middle imprint belt 41 of whenever it piles up the count of a primary imprint at the time of changing the electrification bias impressed to the electrification roller 22 from the electrification bias generating section 121 (count of a periphery) was investigated. This surface potential is the potential of the non-image section. Under the present circumstances, the voltage impressed to conductive layer 41a of the middle imprint belt 41 is fixed to +300V from the primary imprint bias generating section 126, and temperature and humidity are 23 degrees C and 65%RH. The result is shown in drawing 4 (a) and (b). Among drawing, the surface potential of the middle imprint belt 41 is "entomophily surface potential", and has expressed the count of an accumulation primary imprint as "the count of an entomophily periphery."

[0046] Drawing 4 (a) is the photo conductor surface potential V0 by the case where electrification bias is impressed -1200V. It is set to -600V. Before performing a primary imprint, it was entomophily surface potential 300V, but if a primary imprint is performed once, it will carry out to 260V twice, it will carry out to 245V 3 times and it will carry out to 240V 4 times, entomophily surface potential will fall and go to 238V. This is to discharge and accumulate the minus electrification charge of the photo conductor 21 surface in the surface of the middle imprint belt 41, and to go according to the potential difference of the surface potential of a photo conductor 21, and the surface potential of the middle imprint belt 41.

[0047] Drawing 4 (b) is the same drawing at the time of impressing -1400V with -1000V about electrification bias, and is the photo conductor surface potential V0. Although it was entomophily surface potential 300V before being set to -400V and -800V, respectively and performing a primary imprint If a primary imprint is performed once, it will carry out to 287V and 233V twice, respectively, it will carry out to 282V and 209V 3 times, respectively and it will carry out to 280V and 200V 4 times, respectively, it will fall to 280V and 196V, respectively, and will go.

[0048] According to the electrification bias from the above result to a photo conductor 21, the change width of face according to the count of a primary imprint of the surface potential of the middle imprint belt 41 will differ. If the surface potential of the middle imprint belt 41 is changed sharply, primary imprint effectiveness will become unstable. Therefore, as for electrification bias, in the above image formation equipments, it is desirable not to make it change as much as possible.

[0049] In addition, it is the photo conductor surface potential V0 to drawing 5. Although it is

drawing showing the result of having investigated the amount of negative charges charged on the middle imprint belt 41 at the time of the imprint of the 1st round and shifts from this result a little after the 2nd round when the potential difference with entomophily surface potential changes. When the surface potential of the middle imprint belt 41 is changed and the potential difference between the surface potentials V_0 of a photo conductor 21 is changed from this drawing 5, it turns out that the amount of negative charges on the middle imprint belt 41 changes by proportionality according to it. Fluctuation of the amount of negative charges on this middle imprint belt 41 will also fluctuate the imprint effectiveness of the toner image imprinted by the primary imprint voltage of a constant voltage from a photo conductor 21 to the middle imprint belt 41.

[0050] By the way, in the above image formation equipments, in order to adjust the gradation of the image to form conventionally, as a mimetic diagram is shown in drawing 6 (a), the amount of toners which electrification bias is changed, and photo conductor electrification potential is changed, and adheres to the image section is adjusted. In drawing 6 (a), if electrification bias is raised and photo conductor electrification potential is raised from $-500V$ to $-800V$, since the area which potential distribution of the image section and a non-image changes from a continuous line like a dashed line, and is surrounded with the dashed line not more than

development bias $-300V$ of drawing will become small, from development bias $-300V$, the amount of toners adhering to a low potential portion decreases in an absolute value, and it becomes thinner. On the contrary, if photo conductor electrification potential is lowered to $-500V$ from $-800V$, the amount of toners adhering to the image section will increase, and will become deeper.

[0051] However, it is more desirable not to perform gradation adjustment of the image by adjustment of such electrification bias, since the change width of face of the surface potential of the middle imprint belt 41 will become large and primary imprint effectiveness will become unstable, if electrification bias is changed and adjustment of such gradation is performed as mentioned above.

[0052] Then, in this invention, as shown in drawing 6 (b), without changing electrification bias and changing photo conductor electrification potential, the light exposure of the image section is adjusted and the gradation of an image is adjusted. In drawing 6 (b), if the light exposure of the image section is lowered and the exposure section potential of a photo conductor is raised from $-50V$ to $-200V$, since the area which potential distribution of the image section and a non-image changes from a continuous line like a dashed line, and is surrounded with the dashed line not more than development bias $-300V$ of drawing will become small, from development bias $-300V$, the amount of toners adhering to a low potential portion decreases in an absolute value, and it becomes thinner. On the contrary, if light exposure is raised and the exposure section potential of a photo conductor is lowered to $-50V$ from $-200V$, the amount of toners adhering to the image section will increase, and will become deeper.

[0053] By the way, from the properties of a toner differing for every color in the image formation equipment equipped with the development counters 23Y, 23C, 23M, and 23K of four colors in order to pile up the toner of four colors and to form a full color image, as shown in drawing 1, in practice, it responds to the color of a toner and is the photo conductor surface potential V_0 . It must be made to differ. In the above-mentioned example, in order to form the optimal toner image on a photo conductor 21. When forming a yellow toner image by development counter 23Y. By setting electrification bias to $-1400V$, when forming a Magenta toner image in $-800V$ by development counter 23M, the photo conductor surface potential V_0 . Electrification bias is set to $-1300V$ and it is the photo conductor surface potential V_0 . When forming a cyanogen toner image in $-700V$ by development counter 23C. Electrification bias is set to $-1200V$ and it is the photo conductor surface potential V_0 . It is desirable to set electrification bias to $-1100V$ and to make photo conductor surface potential V_0 them $-500V$, when forming a black toner image in $-600V$ by development counter 23K.

[0054] Drawing 7 is drawing showing the result of having investigated the different formation sequence of the toner image of a color and the relation of change of entomophily surface potential, when electrification bias must be changed by the color of the toner developed in this way. Temperature and humidity were set to 23 degrees C and 65%RH.

[0055] this drawing 7 — setting — descending — electrification bias — descending — that is The yellow toner image of -1400V and the 2nd round 1st round The Magenta toner image of -1300V, It is the case where formed the cyanogen toner image of -1200V 3rd round, and the black toner image of -1100V is formed 4th round. With small order The order with electrification bias small on the contrary, i.e., the 1st round, is the case where formed the Magenta toner image of -1300V the cyanogen toner image of -1200V, and 3rd round, and the black toner image of -1100V and the 2nd round form the yellow toner image of -1400V 4th round.

[0056] Although it will fall to 170V and will go if entomophily surface potential performs a primary imprint once when electrification bias performs a primary imprint to descending so that clearly from this drawing 7, it will carry out to 300V twice, it will carry out to 235V 3 times and it will carry out to 194V 4 times When electrification bias performs a primary imprint in small order, and a primary imprint is performed once, to 300V It is [the fall width of face of entomophily surface potential] smaller to fall to 214V, to go, if it carries out twice, it will carry out to 274V 3 times and it will carry out to 245V 4 times, and to perform a primary imprint in order with clearly small electrification bias, it is stabilized more, and a primary imprint can be ensured.

[0057] The image formation method of this invention impresses the primary imprint voltage of fixed voltage from the constant voltage power supply of the primary imprint bias generating section 126, and as mentioned above, the electrification potential of the photo conductor 21 with the electrification roller 22 Although it is fixed at least to the color toner image of each color and gradation adjustment of a toner image is performed by adjusting the light exposure to the image section For that purpose, the electrification bias from the electrification bias generating section 121 It enables it to adjust for gradation adjustment of the reinforcement of laser beam L from the exposure unit 3 by which intensity modulation is carried out according to the picture signal which did not drive possible [adjustment] for gradation adjustment of the toner image to develop, instead was given through the interface 112.

[0058] Moreover, although the set-up electrification bias makes development counters 23Y, 23C, 23M, and 23K choose and contact small order and makes development actuation perform, the engine controller 12 chooses the four above-mentioned development counters 23Y, 23M, 23C, and 23K as order with electrification bias small as mentioned above, and it is made to make the image formation method of this invention contact a photo conductor 21 for that purpose.

[0059] As mentioned above, although the image formation method of this invention has been explained based on an example, this invention is not limited to these examples, but various deformation is possible for it.

[0060]

[Effect of the Invention] According to the image formation method of this invention, a constant voltage power supply is used as a primary imprint bias impression power supply, and the electrification potential of the latent-image support by the electrification means so that clearly from the above explanation Since it is fixed at least to the color toner of each color and gradation adjustment of an image is performed by adjusting the light exposure to the image section Fluctuation of the surface potential on a middle transfer medium while imprinting the toner image of a different color to a middle transfer medium in order can be sharply made small, the imprint effectiveness to the middle transfer medium of a toner image can be stabilized, and the image formation equipment which is reliable, without also producing the cost rise of equipment can be realized.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is drawing showing one operation gestalt of the image formation equipment which applies the image formation method of this invention.

[Drawing 2] It is the block diagram showing the electric configuration of the image formation equipment of drawing 1 .

[Drawing 3] It is the lamination **** cross section of a middle imprint belt and a photo conductor.

[Drawing 4] It is drawing showing the result of having investigated change of the middle imprint hair side of belt side potential of ** which piles up the count of a primary imprint at the time of changing electrification bias.

[Drawing 5] When the potential difference of photo conductor surface potential and a middle imprint belt changes, it is drawing showing the result of having investigated the amount of negative charges charged on a middle imprint belt.

[Drawing 6] It is drawing for explaining gradation adjustment of the conventional image and gradation adjustment of the image of this invention.

[Drawing 7] It is drawing showing the result of having investigated the formation sequence of the toner image when having to change electrification bias by the color of the toner to develop, and the relation of change of entomophily surface potential.

[Drawing 8] It is drawing showing one example of image formation equipment equipped with the middle transfer medium.

[Drawing 9] It is the lamination **** cross section of a middle transfer medium and a photo conductor in the modification of drawing 8 .

[Description of Notations]

E — Engine section

S — Sheet

L — Laser beam

R1 — Primary imprint field

R2 — Secondary imprint ****

PS — Patch sensor

RS — Reading sensor for a synchronization

1 — Control unit

2 — Image support unit

3 — Exposure unit

4 — Imprint unit

5 — Fixing unit

6 — Feeding and discarding paper unit

11 — Main controller

12 — en zincon — truck fatty tuna

21 — Photo conductor

21a — Conductive layer

21b — Sensitization layer

22 — Electrification roller
23 — Development section
23Y — Development counter for yellow
23C — Development counter for cyanogen
23M — Development counter for Magentas
23K — Development counter for blacks
24 — Cleaning section
25 — Developing roller
41 — Middle imprint belt
41a — Conductive layer
41b — Resistive layer
41c — Insulating base
42 — Primary imprint backup roller
43 44 — Roller
45 — Secondary imprint backup roller
46 47 — Roller
48 — Secondary imprint roller
49 — Belt cleaner
50 — Electrode roller
61 — KASETSU
62 — Detachable tray
63 — Feed section
64 — Delivery unit
66 — Re-feeding section
111 — CPU
112 — Interface
113 — Image memory
121 — Electrification bias generating section
122 — Picture signal change over section
123 — CPU
124 — Patch creation module
125 — Development bias generating section
126 — Primary imprint bias generating section
127 — RAM
128 — ROM
129 — Secondary imprint bias generating section
630 — Feed path
637 — Gate roller pair
641a, 641b — Delivery path
642-644 — Roller pair
661-663 — Re-feeding roller pair
664 — Re-feeding path

[Translation done.]

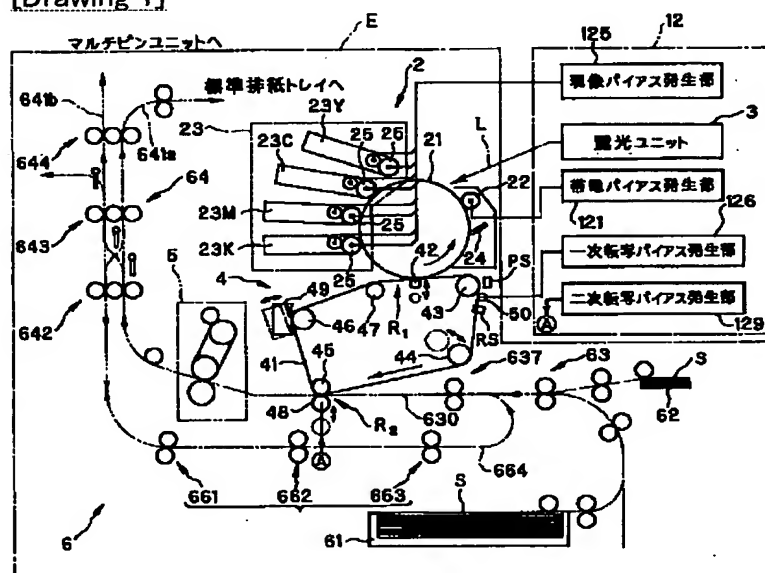
*** NOTICES ***

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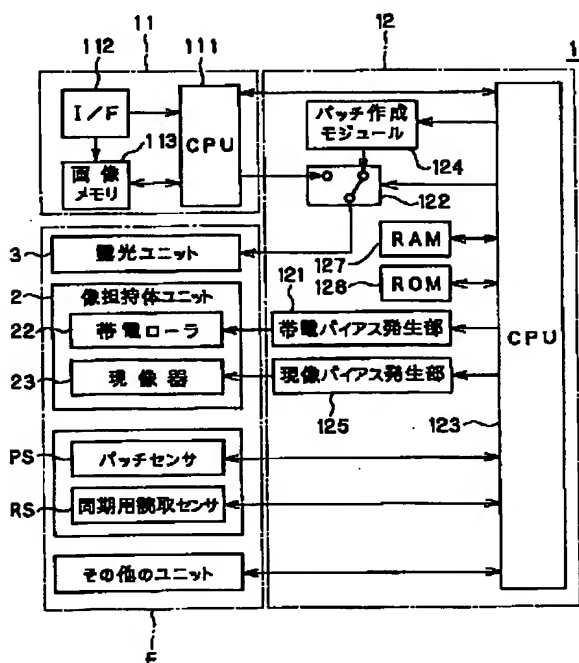
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DRAWINGS

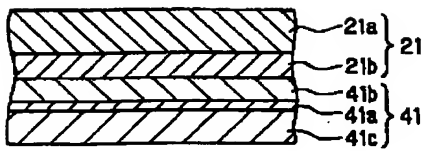
[Drawing 1]



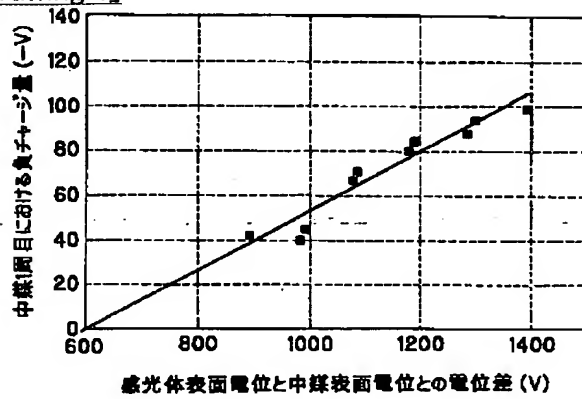
[Drawing 2]



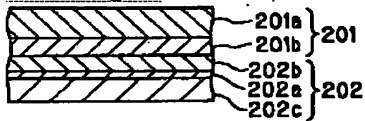
[Drawing 3]



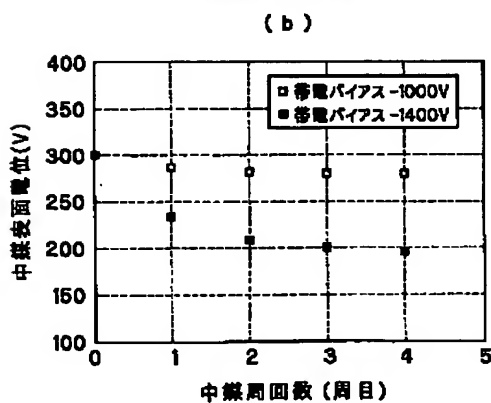
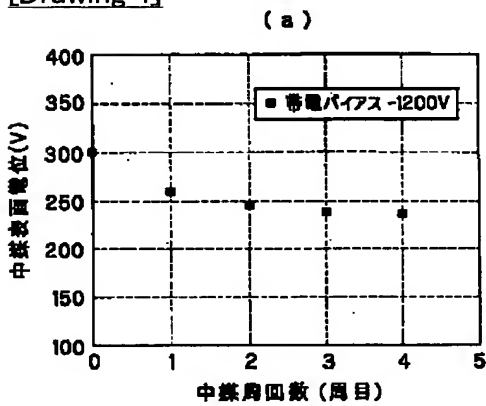
[Drawing 5]



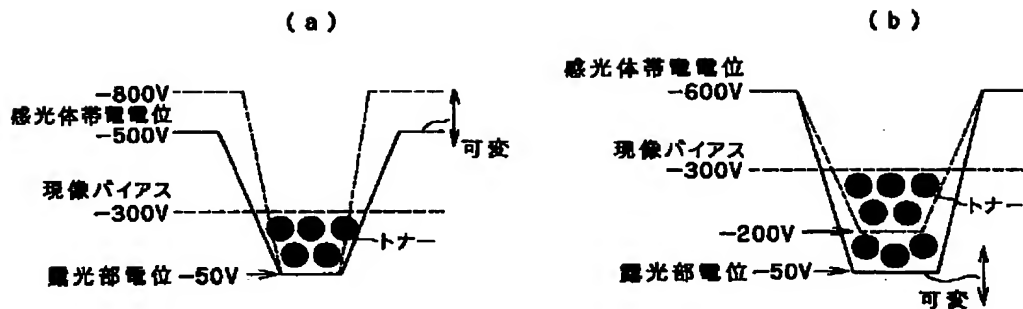
[Drawing 9]



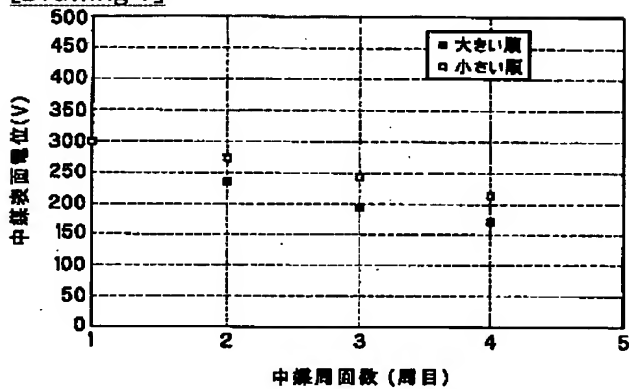
[Drawing 4]



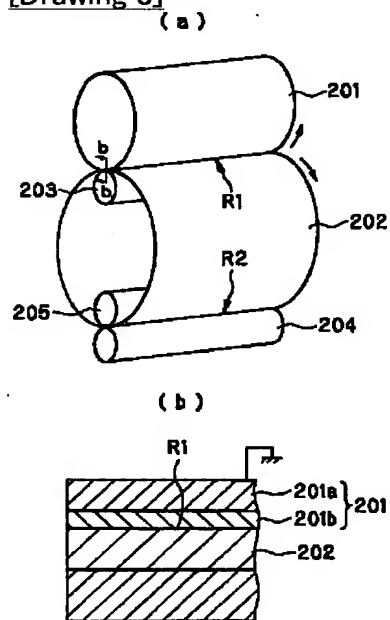
[Drawing 6]



[Drawing 7]



[Drawing 8]



[Translation done.]

等が発生したリ一次転写で203に二つが付着した
場合、部分的に電界が付与できなくなり転写する
不均一となり転写した面位にむらが発生する。

【0012】そこで、中間転写媒体202として、図9
に示すように、合成樹脂からなる絶縁性基板202cの
上に一体的に形成された導電層202aと、その上に一
体的に形成された感光体201に圧接される低抵抗層202
bとで構成されたものを用いるものも知られており、そ
の場合、その中間転写媒体202の側縁部において低
抵抗層202bを帯状に除去して導電層202aを帯状に
露出しておき、この露出部に電極ローラが接触して一次
転写電圧を加えるようにしている。このように導電層2
02aを有する中間転写媒体202を用いる画像形成装
置においては、中間転写媒体202に歪みが発生した
り、転写部のローラに二つが付着した場合には、転写
部全域に均一な転写の電界が付与できず、転写に起
因する面位むらが生じることがある。

【0013】このような一次転写電圧が印加される導電層
202aを有する中間転写媒体202を用いる画像形成
装置においては、高速化のために一次転写と二次転写の
タイミングを重なるようにしなければならないため、一
次転写電圧電源として定電圧電源を、二次転写電圧電
源として定電流電源を用いている（特開9-16039
5号）。

【0014】なお、米国特許第5,243,392号に
おいては、体積抵抗値が略1.012Ωcm以上で、緩和時
間が0.3〜2.00msという高抵抗ペルトの中間転写
媒体を用いて効率的に二次転写を行わせるものが提案
されている。

【0015】
【発明が解決しようとする課題】図8、図9のような構
成において、体積抵抗率の低い中間転写媒体202を用
いると、ライン間にトナーが飛び散ったり付着したりす
る現象が顕著に発生してライン画像の劣化が顕著だっ
たり、感光体メモリを発生させやすかったりするが、中
間転写媒体202の体積抵抗率をある程度高くすること
で、これらの問題は解決可能である。

【0016】しかしながら、抵抗率が高くなると、中間
転写媒体に感光体からの電荷が帯電して電荷が抜け難く
なり、問題が生じる。具体的には、感光体表面電位と中
間転写媒体のペルト表面電位がある一定電位差以上に
なり放電が生じ、中間転写媒体が感光体のマイナス電
荷を受けて（感光体をマイナス帯電する場合）、中間転
写媒体が帯電することが起こる。感光体表面電位 V_0 は、
通常、現象部の現象特性によって異なり、現象部の色
合いは使用初期からの経過時間による特性変化によっ
ても感光体表面電位 V_0 の設定値が大きく異なる。した
って、感光体から中間転写媒体が受け取る負電荷量もま
ちまちで、中間転写媒体表面電位が安定しないことにな
る。

【0017】一次転写を定電流制御することで感光体画
像部に対して一定の仕事をするから、少なくとも一次転
写した瞬間には中間転写媒体表面電位が安定しないこと
による問題は生じない。

【0018】しかしながら、前記したように、一次転写
電圧電源として定電圧電源を用いる場合には、中間転写
媒体表面電位は大きく低下し、感光体画像部との電位差
が不足した状態は解消されないため、転写効率が低下す
るという問題が生じてしまうことが分かった。

【0019】そこで、中間転写媒体に印加する一次転写
電圧を大きくすることが考えられるが、それを大きくし
すぎると、今度は一次転写電圧によって感光体メモリが
発生しやすくなるという問題が起こる。

【0020】本発明は従来技術のこのような問題点を鑑
みてなされたものであり、その目的は、一次転写電圧電
源として定電圧電源を用いる場合の中間転写媒体表面電
位の変動をなくして転写効率を安定化させる画像形成方
式を提供することである。

【0021】

【課題を解決するための手段】上記目的を達成する本発
明の画像形成方法は、回転して帯電手段により表面に
一様に帯電され、露光手段により選択的に放電されて静
電層が形成される画像担持体と、この画像担持体の表
面に選択的に異なる色のカラートナーを付与して画記層
像を可視像とする複数の現象部と、順次異なる色のカラ
ートナーにより形成されたトナー像を中間転写媒体に転
写する一次転写手段と、一次転写部においてバイアスを印
加するための一次転写バイアス印加電源と、中間転写媒
体上に重ね合わせられて転写された全色カラートナー像
を記録紙に転写する二次転写手段とを有する画像形成装置
において、前記一次転写バイアス印加電源として定電圧
電源を用いられ、前記帯電手段による前記画像担持体の
帯電電位は、少なくとも各色のカラートナーに対しては
固定され、画像の階調調整は画像部への露光量を調整す
ることによって行うことを特徴とするものである。

【0022】この場合に、中間転写媒体が、導電層と、
この導電層の上に一体的に形成されたトナーが転写され
るための二次転写バイアス印加電源として定電流電源
が用いられることが望ましい。

【0023】また、二次転写部においてバイアスを印加
するための二次転写バイアス印加電源として定電流電源
が用いられることが望ましい。

【0024】また、帯電手段による画像担持体の帯電電
位が全ての色のカラートナーに対して同一に面定されて
いてもよい。

【0025】また、帯電手段による画像担持体の帯電電
位がカラートナーの色相に異なり、中間転写媒体に転写
するトナー像の転写順序が、帯電手段による画像担持体
の帯電電位がより低い、色のカラートナーから順に高い色

のカラートナーとなるように設定されている。

【0026】本発明においては、一次転写バイアス印加
電源として定電圧電源を用いられ、帯電手段による画像
担持体の帯電電位は、少なくとも各色のカラートナーに
対しては面定され、画像の階調調整は画像部への露光量
を調整することによって行うので、異なる色のトナー像
を順に中間転写媒体に転写する間の中間転写媒体上の表
面電位の変動を大幅に小さくでき、トナー像の中間転写
媒体への転写効率が安定でき、装置のコストアップも
生じず信頼性のある画像形成装置を実現することがで
きる。

【0027】
【発明の実施の形態】以下、本発明の画像形成方式を適
用する電子写真法を用いた画像形成装置のプリンターの
1例の全体の構成を説明する。

【0028】図1は、本発明の画像形成方式を適用する
画像形成装置の1つの実施形態を示す図である。また、
図2は、図1の画像形成装置の電気的構成を示すブロ
ク図である。この画像形成装置は、イエロー（Y）、シ
アン（C）、マゼンタ（M）、ブラック（K）の4色の
トナーを重ね合わせてフルカラー画像を形成したり、ブ
ラック（K）のトナーのみを用いてモノクロ画像を形成
する装置である。この画像形成装置では、ホストコンピ
ュータ等の外部装置から画像信号が制御ユニット1のメ
インコントローラ11に与えられ、このメインコン
トローラ11からの指令に応じてエンジンコントローラ
12と画像形成手段として機能するエンジン部Eの各部
を制御してシートSに画像信号に対応する画像を形成す
る。

【0029】このエンジン部Eでは、像担持体ユニット
2の感光体21にトナー像を形成可能となっている。す
なわち、像担持体ユニット2は、図1の矢印方向に回転
可能な感光体21を備えており、さらに、感光体21の
周りにその回転方向に沿って、帯電手段としての帯電ロ
ーラ22、現像手段としての現像器23Y、23C、2
3M、23K、及び、クリーニング部24がそれぞれ配
置されている。帯電ローラ22は、帯電バイアス発生部
121から帯電電圧が印加されており、感光体21の外周
面に当接して外周面を均一に帯電させる。感光体21
は、図3に示すように、導電層21aと、この導電層2
1a上に形成された感光層21bとを有している。

【0030】そして、この帯電ローラ22によって帯電
された感光体21の外周面に向けて露光ユニット3から
レーザ光が照射される。この露光ユニット3は、図2
に示すように、画像信号切換部122と電気的に接続さ
れており、この画像信号切換部122を介して与えられ
る画像信号に応じてレーザ光Lを感光体21上に走査露
光して感光体21上に画像信号に対応する静電層像を形
成する。例えば、エンジンコントローラ12のCPU1
23からの指令に基づき、画像信号切換部122がパッ

チ作成モジュール124と導通している際には、パッチ
作成モジュール124から出力されるパッチ画像信号が
露光ユニット3に与えられてパッチ画像が形成される。
一方、画像信号切換部122がメインコントローラ11
のCPU111と導通している際には、ホストコンピ
ュータ等の外部装置よりインターフェース112を介して
与えられて画像信号に応じてレーザ光Lを感光体21上
に走査露光して感光体21上に画像信号に対応する静電
層像が形成される。

【0031】こうして形成された静電層像は現像部23
によってトナー現像される。すなわち、この実施形態で
は、現像部23として、イエロー用の現像器23Y、シ
アン用の現像器23C、マゼンタ用の現像器23M、及
び、ブラック用の現像器23Kがこの順序で感光体21
に沿って配置されている。これらの現像器23Y、23
C、23M、23Kは、それぞれ感光体21に対して接
離自在に構成されており、エンジンコントローラ12か
らの指令に応じて、上記4つの現像器23Y、23M、
23C、23Kの中の1つの現像器が選択的に感光体2
1に当接すると共に、現像バイアス発生部125によっ
て高電圧で現像器の現像ローラ25に印加されて選択さ
れた色のトナーを感光体21の表面に付与して感光体2
1上の静電層像を顕在化する。

【0032】現像部23で現像されたトナー像は、ブラ
ック用現像器23Kとクリーニング部24との間に位置
する一次転写領域R1で転写ユニット4の中間転写ペ
ルト41上に一次転写される。なお、この転写ユニット4
の構造については後で詳述する。

【0033】また、一次転写領域R1から周方向（図1
の矢印方向）に進んだ位置には、クリーニング部24が
配置されており、一次転写後に感光体21の外周面に残
留付着しているトナーを掻き落とす。

【0034】次に、転写ユニット4の構成について説明
する。この実施形態では、転写ユニット4は、ローラ4
2〜47と、これら各ローラ42〜47に掛け渡された
中間転写ペルト41と、この中間転写ペルト41に転写
された中間トナー像をシートSに二次転写する二次転写
ローラ48とを備えている。

【0035】この中間転写ペルト41は、図9で説明し
た従来例と同様に、図3に断面を示すように、合成樹脂
からなる絶縁性基板41cの上に一体的に形成された導
電層41aと、その上に一体的に形成された感光体21に
圧接される低抵抗層41bとで構成されたものを用いてお
り、その中間転写ペルト41の側縁部において低抵抗層4
1bを帯状に除去して導電層41aを帯状に露出してお
き、この露出部に電極ローラ50が接触することによ
り、一次転写バイアス発生部126から一次転写電圧が
印加されている。そして、カラー画像をシートSに転写
する場合には、一次転写バックアップローラ42と異
なり、位置へ変換させて中間転写ペルト41を感光体21に圧

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接させて、感光体21上に形成される各色のトナー像を中間転写ベルト41の導電層641aに印加された一次転写電圧によって中間転写ベルト41上に転写させる。感光体21と中間転写ベルト41を循環駆動させて各色のトナー像を中間転写ベルト41上に重ね合わせて転写してカラー像を形成すると共に、給排紙ユニット6の給紙部63においてシートSの非画像形成面が中間転写ベルト41を向いて当該面に画像を二次転写可能となる。

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【0041】なお、図2において、符号113はホストコンピュータ等の外部装置よりインターフェース112を介して与えられた画像を記憶するためにメインコンローラ11に設けられた画像メモリであり、符号127はエンジン部Eを制御するための制御データやCPU123における演算結果等を一時的に記憶するためのRAMであり、さらに、符号128はCPU123で実行演算プログラム等を記憶するROMである。

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【0042】ここで、上記の画像形成装置においては、一次転写部R1で中間転写ベルト41に一次転写電圧を印加する一次転写バイアス発生部126は定電圧電源から構成され、二次転写部R2で二次転写ローラ48に二次転写電圧を印加する二次転写バイアス発生部129は定電流電源から構成されている。

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【0043】また、中間転写ベルト41の抵抗値41bの体積抵抗率は、一次転写電圧250V印加時で $1.5 \times 10^{12} \Omega \cdot \text{cm}$ (23°C、65%RH)である。

【0044】また、ローラ43の近傍には、感光体21にマイナスイオン帯電一成分排湿性トナーで反転現象する場合について検討する。

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【0045】まず、帯電バイアス発生部121から導電ローラ22に印加する帯電バイアスを変化させた場合の、一次転写回数と重ねる毎(周回数)の中間転写ベルト41の表面電位の変化を調べた。この表面電位は非画像部の電位である。この際、一次転写バイアス発生部126から中間転写ベルト41の導電層641aに印加する電圧は+300Vに固定しており、温度と湿度は23°C、65%RHである。その結果を図4(a)、(b)に示す。図中、中間転写ベルト41の表面電位は「中継表面電位」で、累積一次転写回数を「中継回数」で表している。

【0046】図4(a)は、帯電バイアスを-1200V印加した場合で、感光体表面電位 V_0 は-600Vになる。一次転写を行う前は、中継表面電位300Vであったが、一次転写を1回行うと260Vに、2回行うと245Vに、3回行うと240Vに、4回行うと238Vの中継表面電位は低下して行く。これは、感光体21の表面電位と中間転写ベルト41の表面電位の電位差に比べて感光体21表面のマイナスイオン帯電電荷が中間転写ベルト41の表面に放電して蓄積されて行くためである。

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【0047】図4(b)は、帯電バイアスを-1000

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Vと-1400V印加した場合の図であり、感光体表面電位 V_0 はそれぞれ-400V、-800Vになり、一次転写を行う前は、中継表面電位300Vであったが、一次転写を1回行うとそれぞれ287V、233Vに、2回行うとそれぞれ282V、209Vに、3回行うとそれぞれ280V、200Vに、4回行うとそれぞれ280V、196Vに低下して行く。

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【0048】以上の結果から、感光体21への帯電バイアスに応じて中間転写ベルト41の表面電位の一次転写回数に比べて電位差は異なることになる。中間転写ベルト41の表面電位が大きく変動すると、一次転写効率が高不安定になってしまう。したがって、上記のような画像形成装置においては、可能な限り帯電バイアスは変化させないことが望ましい。

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【0049】なお、図5に感光体表面電位 V_0 と中継表面電位との電位差が変化する場合に、1周目の転写時に調べた結果を示す図であり、2周目以降においては若干この結果からずれるが、この図5から、中間転写ベルト41の表面電位が変動して感光体21の表面電位 V_0 との間の電位差が変動すると、中間転写ベルト41上の負電荷量がそれに比べて比例関係で変化することが分かる。この中間転写ベルト41上の負電荷量が変動すると、定電圧の一次転写電圧によって感光体21から中間転写ベルト41へ転写されるトナー量の転写効率も変動してしまう。

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【0050】ところで、上記のような画像形成装置において、従来は形成する画像の階調を調整するために、図6(a)に模式図を示すように、帯電バイアスを変えて感光体表面電位を変化させて画像部に付着するトナー量を調整している。図6(a)において、帯電バイアスを上げて感光体表面電位を-500Vから-800Vに上げると、画像部と非画像部の電位分布は塗料から塗料のようになり、図の現象バイアス-300V以下の塗料で塗られる面積が小さくなるので、現象バイアス-300Vより絶対値で低い電位部分に付着するトナー量は減少し、より薄くなる。逆に、感光体表面電位を-800Vから-500Vに下げると、画像部に付着するトナー量は増加し、より濃くなる。

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【0051】しかしながら、以上のように、このような階調の調整を帯電バイアスを変えて行うと、中間転写ベルト41の表面電位の変化幅が大きくなり、一次転写効率が高不安定になってしまうので、このような帯電バイアスの調整による画像の階調調整は行わない方が望ましい。

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【0052】そこで、本発明においては、図6(b)に示すように、帯電バイアスを変えて感光体表面電位を変化させずに、画像部の露光量を調整して画像の階調を調整するようにする。図6(b)において、画像部の露光量を下げた感光体の露光電位を-500Vから-200

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Vに上げると、画像部と非画像部の電位分布は塗料から塗料のようになり、図の現象バイアス-300V以下の塗料で塗られる面積が小さくなるので、現象バイアス-300Vより絶対値で低い電位部分に付着するトナー量は減少し、より薄くなる。逆に、露光量を上げて感光体の露光電位を-200Vから-50Vに下げると、画像部に付着するトナー量は増加し、より濃くなる。

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【0053】ところで、図1に示すように、4色のトナーを重ね合わせてフルカラー画像を形成するために4色の現象電圧23V、23C、23M、23Kを備える画像形成装置においては、色毎にトナーの特性が異なることから、実際上、トナーの色に応じて感光体表面電位 V_0 を異ならせざるを得ない。上記実施例においては、最適なトナー像を感光体21上に形成するためには、現象電圧23Vでイエロートナー像を形成する場合は、帯電バイアスを-1400Vにして感光体表面電位 V_0 を-800Vに、現象電圧23Mでマゼンタトナー像を形成する場合は、帯電バイアスを-1300Vにして感光体表面電位 V_0 を-700Vに、現象電圧23Cでシアントトナー像を形成する場合は、帯電バイアスを-1200Vにして感光体表面電位 V_0 を-600Vに、現象電圧23Kでブラックトナー像を形成する場合は、帯電バイアスを-1100Vにして感光体表面電位 V_0 を-500Vにすることが望ましい。

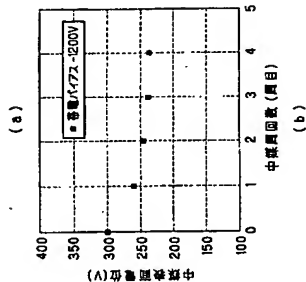
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【0054】図7は、このように現象するトナーの色による色のトナー像の形成順序と中継表面電位の変化の関係を調べた結果を示す図である。温度と湿度は23°C、65%RHとした。

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【0055】この図7において、大きい順とは、帯電バイアスが大きき順、すなわち、1周目は-1400Vのイエロートナー像、2周目は-1300Vのマゼンタトナー像、3周目は-1200Vのシアントトナー像、4周目は-1100Vのブラックトナー像を形成した場合であり、小さい順とは、その反対に帯電バイアスが小さい順、すなわち、1周目は-1100Vのブラックトナー像、2周目は-1200Vのシアントトナー像、3周目は-1300Vのマゼンタトナー像、4周目は-1400Vのイエロートナー像を形成した場合である。

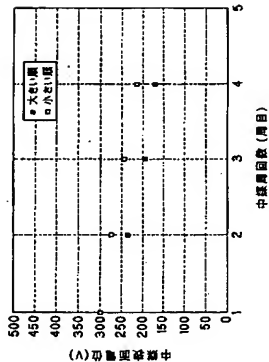
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【0056】この図7から明らかなように、帯電バイアスが大きき順に一次転写を行う場合、中継表面電位は一次転写を1回行うと300Vに、2回行うと235Vに、3回行うと194Vに、4回行うと170Vに低下して行くが、帯電バイアスが小さい順に一次転写を行う場合、一次転写を1回行うと300Vに、2回行うと274Vに、3回行うと245Vに、4回行うと214Vに低下して行く。明らかに帯電バイアスが小さい順に一次転写を行う方が、中継表面電位の低下幅は小さく、より安定して塗料に一次転写を行うことができる。

【0057】以上のように、本発明の画像形成方式は、

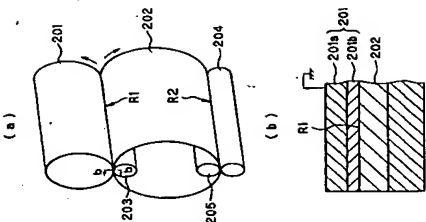
【図4】



【図7】



【図8】



フロントページの続き

(51)Int. Cl. 7

G03G 15/16

F I

リーコード (参考)

Fターム(参考) 2H027 EA01 EA02 EA03 EB03 EB04
EC20 ED03 ED04 ED24
2H030 AA03 AD01 AD02 AD19 BB13
BB23 BB42 BB54
2H032 AA05 AA15 BA09 CA02 CA12
CA15
2H076 DA06

【図6】

